10/532,155 (4/28/08 T.T)

Express Mail Label No. EV 292457545 US
Docket No.: S1022.81236US00
Mailed April 20, 2005

The first part of a typical OFDM frame comprises a preamble, for example aHIPERLAN/2 preamble consists of a short (STS) and a long training sequence (LTS). The 10 STS contains repetitions of a training symbol with duration of 800ns on 12subcarriers. Each of the symbols is a quarter of the duration of the part of a normal data symbol ~~analysed~~ analyzed by the Fast Fourier Transform. Each data symbol of an OFDM signal has a cyclic prefix, i.e., the first To seconds part of each OFDM symbol is identical to the last part. The preamble also includes a long training sequence which two data symbol and a cyclic prefix. The STS may be used for coarse frequency estimation whereas the LTS may be used for precise frequency estimation. The STS may also be used for symbol timing estimation by cross-correlation.--

page3,
Please amend lines 1-7 as shown below: 4/28/08 T.T.

--An object of the present invention is to provide a method and apparatus for improved ~~synchronisation~~ synchronization of a received signal.

A further object of the present invention is to provide a method and a system which allows robust ~~synchronisation~~ synchronization even under extreme conditions.

Still a further object of the present invention is to provide a method and a system which allows ~~synchronisation~~ synchronization with lower risk of perturbation caused by intersymbol interference.--

page3,
Please amend lines 24-32 as shown below: 4/28/08 T.T.

--The frequency offset estimation unit may comprise means for determining a phase shift in the autocorrelation signal of the received signal. The receiver may also comprise means to detect a characteristic curve indicative of a known training sequence in the phase of the autocorrelation signal. The receiver may comprise means to detect a characteristic curve indicative of a known training sequence in the amplitude of the autocorrelation signal. The characteristic curve may include peaks and/or troughs. To avoid spurious ~~synchronisations~~ synchronizations threshold values may also be used to make sure that only very significant peaks and troughs are detected while not being misled by the exact form of the peak or the trough. The threshold values may be set dynamically.--

Express Mail Label No. EV 292457545 US
Docket No.: S1022.81236US00
Mailed April 20, 2005

Please amend lines 4-18 on page 4 as shown below:

--The receiver may have means for determining an autocorrelation signal from a further known sequence of the received signal. For example, the receiver may have means for determining a phase shift in the autocorrelation signal from a further known sequence of the received signal. The time reference determining unit may comprise means to determine a characteristic curve indicative of a known training sequence or a further known sequence in the amplitude of the autocorrelation signal. The time reference determining unit may comprise means to determine a characteristic curve indicative of a known training sequence in the phase of the autocorrelation signal. The time reference determining unit may comprise means to determine a characteristic curve indicative of a known training sequence in the amplitude of the cross-correlation of the compensated received sequence with the known training sequence. The characteristic curve may include peaks and/or troughs. To avoid spurious ~~synchronisations~~ <u>synchronizations</u> threshold values may also be used to make sure that only very significant peaks and troughs are detected while not being misled by the exact form of the peak or the trough. The threshold values may be set dynamically.--

Please amend pages 5, lines 3-10 as shown below: 4/28/08 T.T.

--The present invention also provides a receiver which receives a signal comprising a first and second known training sequence and uses autocorrelation of the first or the second known sequence for CFO estimation, autocorrelation of the first known sequence for a first timing and cross-correlation of the second known sequence for a second timing. Either the first or the second timing may be selected as the timing of the received signal. The first known sequence may be an STS sequence of a preamble and second known sequence may be an LTS of a preamble. The use of different known sequences increase the accuracy of the ~~synchronisation~~ <u>synchronization</u>.--

Please amend the paragraphs beginning on page 6, line 8 of through page 7, line 1 of as shown below:

Express Mail Label No. EV 292457545 US
Docket No.: S1022.81236US00
Mailed April 20, 2005

Fig. 4 is a representation of an autocorrelation unit and frequency offset unit which may be used with the timing and frequency ~~synchronisation~~ synchronization unit of Fig. 3.--

Please amend lines 27-28 on page 7 as shown below:

--Fig. 6 shows a cross-correlator in the form of a matched filter for use in the timing and frequency ~~synchronisation~~ synchronization unit of Fig. 3.--

Please amend the paragraph beginning on page 7, line 33 through page 8, line 1 as shown below:

--Fig. 9a is a schematic block diagram of a ~~synchronisation~~ synchronization machine in accordance with an embodiment of the present invention.--

Please amend lines ~~6-17~~ 6-16 on page 8 as shown below: 4/28/08 T.T.

--Fig. 10a shows how a sliding correlation can be performed. Figs. 10b and 10c show forms of sliding correlations with varying correlation distance D which may be used with the present invention.

Figs.11a and 11b show schematic representations of the mechanism of autocorrelation and cross correlation which can be used with the present invention. Fig. 11c shows a time domain rotor.

Fig. 12 shows a characteristic down-up-down signature structure used in accordance with embodiments of the present invention to determine ~~synchronisation~~ synchronization.

Figs.13a and 13b show the results of a sliding correlation on the LTS portion of a preamble when there is a CFO, Fig.13a shows the amplitude signal and Fig.13b the phase signal.--

Please replace lines 26-28 on page 8 as shown below:

--Figs.17a, 17b, 17c show various cross-correlation strategies in accordance with embodiments of the present invention.

10/532,155 4/28/08 T.T.

Express Mail Label No. EV 292457545 US
Docket No.: S1022.81236US00
Mailed April 20, 2005

relative upper and a lower threshold using the maximum and the minimum values of the sliding correlation amplitude. These threshold values may be adapted dynamically to improve synchronisation-~~synchronisation~~ synchronization. Using these threshold values, it searches for the first sample where the sliding correlation amplitude is less than the upper threshold and at a previous point within the relevant distance, the correlation amplitude is greater than the lower threshold. The distance between these points is configurable by the processor 52. The peak of the correlation is the end of the STS. Now, the processor 52 checks for the phase jump of π (pi) between the current point and a previous point within a predefined distance in the phase signal from unit 44. The correlation phase is represented by two values having a phase offset in between, which is also configurable by the processor 52.--

Please amend the paragraphs beginning on page 25, line 32 through page 27, line 14 4/28/08 T.T.

--The accurate symbol timing is obtained from the cross-correlation of the CFO compensated samples with a known training sequence available from unit 50. The processor searches for a particular waveform in this output depending upon the training sequence involved, e. g. searches for a large peak in this output. To ~~localise~~ localize this peak the rough ~~synchronisation~~ synchronization from the STS can be used to provide a window. The timing reference either rough or accurate is an output of the processor unit51. The cross- correlation can be done with a suitable known sequence, e. g. the STS or the LTS or both of the preambles of Fig. 2.

The above receiver may be configured to be a multimode receiver, i.e., it can receive and process any of the preambles of Fig. 2. To achieve this the processor 52 makes use of the configuration signals 53-56 to set the ~~synchronisation~~ synchronization unit to the appropriate algorithm.

The present invention also includes software computer programs which contain code which when executed on a processing means to carry out one or more of the methods of the invention. The ~~sofware~~ software may include code for processing a received signal comprising a carrier modulated with a known training sequence, comprising: code of obtaining an estimate of a carrier frequency offset from an autocorrelation signal obtained by autocorrelation of the part

10/532,155 4/28/08 T.T.

Express Mail Label No. EV 292457545 US
Docket No.: S1022.81236US00
Mailed April 20, 2005

4/28/08 T.T.

Please amend lines ~~22-27~~ 22-31 on page 27 as shown below:

--The present invention may find advantageous use in receivers for telecommunications systems, especially for wireless communication systems and particularly for OFDM systems such as Local Area Networks (LAN). The present invention allows an accurate and robust ~~synchronisation~~ synchronization which is essential for operation at high bit rates and which can provide better bit error rate and improved quality of communication.

While the invention has been shown and described with reference to preferred embodiments, it will be understood by those skilled in the art that various changes or modifications in form and detail may be made without departing from the scope and spirit of this invention.--

On page 27, line 32, please insert the following:

--What is claimed is:--